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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/580,394

05/22/2006

Kyung Sang Cho

PHO0024US

1954

23413 7590 10/07/2011
CANTOR COLBURN LLP
20 Church Street
22nd Floor
Hartford, CT 06103

EXAMINER

BREVAL, ELMITO

ART UNIT

PAPER NUMBER

2889

NOTIFICATION DATE

DELIVERY MODE

10/07/2011

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

usptopatentmail@cantorcolburn.com

Office Action Summary	Application No.	Applicant(s)	
	10/580,394	CHO ET AL.	
	Examiner	Art Unit	
	ELMITO BREVAL	2889	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 August 2011.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 5) ☒ Claim(s) 1-5 and 7-10 is/are pending in the application.
- 5a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 6) ☐ Claim(s) ____ is/are allowed.
- 7) ☒ Claim(s) 1-5 and 7-10 is/are rejected.
- 8) ☐ Claim(s) ____ is/are objected to.
- 9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 12) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. ____. |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date ____. | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Response to Amendment

The amendment filed on 08/30/2011 has been entered.

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 08/30/2011 has been entered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-5, 7-9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bulovic et al., (US. Pub: 2004/0023010) of record in view of Alivisatos et al., (US. Pat: 5,537,000) in further view of Chen et al., (US. Pub: 2004/0251824 A1) of record.

Regarding claim 1, Bulovic ('010) teaches (in at least fig. 1; claim 20) a quantum dot light emitting device comprising: a top electrode (5); a bottom electrode (2) disposed substantially opposite the top electrode on the substrate (1); an inorganic quantum dot light emitting layer (not shown; [0027]) provided between the top electrode and the bottom electrode; and an electron transport layer (4) is disposed on the inorganic quantum dot light emitting layer and the top electrode (5) is formed on top of it; and an organic hole transport layer (3) is disposed between the inorganic quantum dot light emitting layer (not shown) and the bottom electrode (2), wherein the organic hole transport layer is made of material selected from the group consisting of TPD ([0029]).

However, Bulovic ('010) does not expressly disclose the electron transport layer is inorganic and the substrate is made of polyethyleneterephthalate or polycarbonate; and wherein the thickness of the inorganic electron transport layer is in the range of about 10 nm to 100 nm.

Alivisatos discloses (in at least figs. 1-10) a light emitting device comprised of, in part, an inorganic electron transport layer (col. 5-col. 6, line 13), wherein the thickness of the inorganic electron transport layer is in the range of 20 nm to 100 nm (col. 7, lines 20-33) for the purpose of enhancing the electron injection to the light emitting layer and

Art Unit: 2889

to improve the luminance efficiency of the device, but silent about the substrate is made of polyethyleneterephthalate or polycarbonate.

However, it is well known in the art to form light emitting display device with substrates made of polyethyleneterephthalate or polycarbonate because of their high transparency and flexibility. For instance, Chen ('824) teaches (in at least fig. 2) a display device comprised of, in part, a substrate (14) wherein the substrate is made of polycarbonate ([0037]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the inorganic electron transport layer of Alivisatos in the device of Bulovic for the purpose of enhancing the electron injection to the light emitting device and to improve the luminance efficiency of the device and to further modify with the polycarbonate substrate of Chen in order to have a device with good light transparency and flexibility.

Regarding claim 2, Bulovic ('010) as modified by Alivisatos ('000) and Chen ('824) teaches (in at least fig. 1 of Bulovic) the quantum dot light-emitting diode further comprises: a substrate (1) disposed beneath the bottom electrode (2), wherein the organic hole transport layer (3; [0029]) is disposed on the bottom electrode (2), wherein the bottom electrode (2) is an anode and the top electrode (5) is a cathode, wherein the anode (2), the organic hole transport layer (3), the inorganic quantum dot light emitting layer (not shown in the fig. [0027]; see at least claim 20), the inorganic electron transport layer (col. 5-col. 6, line 13 of Alivisatos) and the cathode (5) are formed in this order on the substrate (1).

Regarding claim 3, Bulovic ('010) as modified by Alivisatos ('000) and Chen ('824) discloses the electron transport layer is made of a semiconductor compound selected from the group consisting of CdS, ZnSe and ZnS (col. 6, lines 4-8 of Alivisatos).

Regarding claim 4, Bulovic ('010) teaches (in paragraph [0033]) the inorganic quantum dot light emitting layer is made of a material selected from the group consisting of: group III-V compound nanocrystals including CdS, CdSe, ZnS, ZnTe, HgS, HgSe and HgTe.

Regarding claim 5, the limitation "inorganic electron transport layer is formed by a solution coating process selected from the group consisting of sol-gel coating, spin coating, printing casting and spraying, or a vapor coating process selected from the group consisting of chemical vapor (CVD), sputtering, e-beam evaporation and vacuum deposition" is a product-by-process limitation. In spite of the fact a product-by-process may recite process limitations; it is the product not the recited process that is covered by the claim. Furthermore, patentability of a claim to a product does not rest merely in the difference in the method by which the product is made. Rather, it is the product itself which must be new and not obvious. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a difference process. In re Thorpe, 777 F. 2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Regarding claim 7, Bulovic ('010) as modified by Alivisatos ('000) and Chen ('824) discloses the electron transport layer is made of a semiconductor compound

Art Unit: 2889

selected from the group consisting of CdS, ZnSe and ZnS (col. 6, lines 4-8 of Alivisatos).

Regarding claim 8, Bulovic ('010) teaches (in paragraph [0033]) the inorganic quantum dot light emitting layer is made of a material selected from the group consisting of: group III-V compound nanocrystals including CdS, CdSe, ZnS, ZnTe, HgS, HgSe and HgTe.

Regarding claim 9, the limitation "inorganic electron transport layer is formed by a solution coating process selected from the group consisting of sol-gel coating, spin coating, printing casting and spraying, or a vapor coating process selected from the group consisting of chemical vapor (CVD), sputtering, e-beam evaporation and vacuum deposition" is a product-by-process limitation. In spite of the fact a product-by-process may recite process limitations; it is the product not the recited process that is covered by the claim. Furthermore, patentability of a claim to a product does not rest merely in the difference in the method by which the product is made. Rather, it is the product itself which must be new and not obvious. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a difference process. In re Thorpe, 777 F. 2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Regarding claim 10, Bulovic ('010) teaches (in at least fig. 1; claim 20) a quantum dot light emitting device comprising: a top electrode (5); a bottom electrode (2) disposed substantially opposite the top electrode on the substrate (1); an inorganic quantum dot light emitting layer (not shown; [0027]) provided between the top electrode

Art Unit: 2889

and the bottom electrode; and an electron transport layer (4) is disposed on the inorganic quantum dot light emitting layer and the top electrode (5) is formed on top of it; and an organic hole transport layer (3) is disposed between the inorganic quantum dot light emitting layer (not shown) and the bottom electrode (2), wherein the organic hole transport layer is made of material selected from the group consisting of TPD ([0029]).

However, Bulovic ('010) does not expressly disclose the electron transport layer is inorganic; and wherein the inorganic electron transport layer includes an oxide selected from group consisting of TiO₂, ZnO, SiO₂, SnO₂, WO₃, Ta₂O₃, BaTiO₃, BaZrO₃, ZrO₂, HfO₂, Al₂O₃, Y₂O₃, and ZrSiO₄; the nitride Si₃N₄; or a semiconductor compound selected from the group consisting of CdS, ZnSe and ZnS; and wherein the thickness of the inorganic electron transport layer is in the range of about 10 nm to 100 nm; and the substrate is made of polyethyleneterephthalate or polycarbonate.

Alivisatos discloses (in at least figs. 1-10) a light emitting device comprised of, in part, an inorganic electron transport layer (col. 5-col. 6, line 13); and wherein the inorganic electron transport layer includes an oxide selected from group consisting of TiO₂, ZnO, SiO₂, SnO₂, WO₃, Ta₂O₃, BaTiO₃, BaZrO₃, ZrO₂, HfO₂, Al₂O₃, Y₂O₃, and ZrSiO₄; the nitride Si₃N₄; or a semiconductor compound selected from the group consisting of CdS, ZnSe and ZnS (col. 6, lines 4-13). Alivisatos further discloses the thickness of the inorganic electron transport layer is in the range of 20 nm to 100 nm (col. 7, lines 20-33) for the purpose of enhancing the electron injection to the light

Art Unit: 2889

emitting layer and to improve the luminance efficiency of the device, but silent about the substrate is made of polyethyleneterephthalate or polycarbonate.

However, it is well known in the art to form light emitting display device with substrates made of polyethyleneterephthalate or polycarbonate because of their high transparency and flexibility. For instance, Chen ('824) teaches (in at least fig. 2) a display device comprised of, in part, a substrate (14) wherein the substrate is made of polycarbonate ([0037]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the inorganic electron transport layer of Alivisatos in the device of Bulovic for the purpose of enhancing the electron injection to the light emitting device and to improve the luminance efficiency of the device and to further modify with the polycarbonate substrate of Chen in order to have a device with good light transparency and flexibility.

Response to Arguments

Applicant's arguments with respect to claims 1-5 and 6-10 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ELMITO BREVAL whose telephone number is (571)270-3099. The examiner can normally be reached on M-F (8:30 AM-5:00 Pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Toan Ton can be reached on (571)-272-2303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Karabi Guharay/
Primary Examiner, Art Unit 2889

September 12, 2011
/Elmito Breval/
Examiner, Art Unit 2889